

REMARKS

Claims 1-8, 10-25, and 34-75 are pending in the application with claims 1, 13, 19, 34, and 40 amended herein and claim 9 cancelled herein. The title is objected to as not being descriptive. The title is amended herein to clearly indicate the invention to which the claims are directed.

Claims 1-9, 11, 13-14, 16-41, 43-47 stand rejected under 35 U.S.C. 102(e) as being anticipated by Raaijmakers. Applicant requests reconsideration. Applicant notes that claims 26-33 were previously cancelled.

Amended claim 1 sets forth a capacitor fabrication method that includes, among other features, forming a first capacitor electrode, atomic layer depositing a conductive barrier layer to oxygen diffusion over the first electrode forming a capacitor dielectric layer over the barrier layer, and forming a second capacitor electrode over the dielectric layer. Pages 3-4 of the Office Action allege that Raaijmakers (hereinafter Ra) discloses the claimed method. However, thorough review of Ra and the particular portions of Ra recited and relied upon by the Office on pages 3-4 of the Office Action reveals that Ra does not disclose atomic layer depositing a conductive barrier layer to oxygen diffusion over a first electrode.

Page 3 of the Office Action states that Ra discloses "a conductive barrier layer 304 or monolayer which originally contain HSG" over bottom electrode 300 allegedly shown in Fig. 8. Nevertheless, it is clearly apparent from the express teachings of Ra that HSG layer 304 is not intended to function as a barrier layer and does not in fact function as a barrier layer. Figs. 7-10 show that bottom electrode 300 is exposed through HSG layer 304 that supposedly acts as barrier layer. Since bottom electrode 300 is exposed through HSG layer 304, it is impossible for HSG layer 304 to function as a barrier layer.

Further, paragraph [0150] of Ra specifically describes an insulative barrier layer 306 formed from silicon nitride over HSG layer 304 to protect it against oxidation. If HSG layer 304 constitutes a barrier layer as alleged by the Office, then no need would exist to protect HSG layer 304 with insulative barrier layer 306. Notably, barrier layer 306 is insulative rather than conductive, as set forth in claim 1.

In addition, the Office fails to establish that silicon is somehow regarded as a barrier material. Applicant asserts that silicon, of which HSG layer 304 is made, is not considered by those of ordinary skill as a barrier material. Thus, at least for the reasons described herein, Applicant asserts that HSG layer 304 does not disclose a conductive barrier layer to oxygen diffusion, as set forth in claim 1.

Claim 1 further sets forth that the conductive barrier layer to oxygen diffusion is atomic layer deposited over the first electrode. Page 3 of the Office Action alleges that Ra discloses "atomic layer depositing a conductive barrier layer 304 or monolayer which originally contain HSG," and relies upon Figs. 2, 4A, 4B, or the abstract as allegedly describing such atomic layer deposition. However, reference to the recited text as well as the remainder of Ra does not reveal even a mention of forming HSG layer 304 by atomic layer deposition. Paragraph [0010] of Ra describes formation of HSG silicon but does not provide any mention of atomic layer depositing such a material.

Applicant acknowledges that Figs. 4A and 4B describe forming a self-terminating monolayer, but reference to paragraph [0044] and [0063] of Ra makes it clearly apparent that Ra only contemplates using formation of a self-terminating monolayer in fabricating capacitor dielectric layers. Ra does not in any way disclose, or even suggest, that atomic layer deposition (ALD) may be used for forming HSG layer 304.

Further, Applicant asserts that no suggestion or motivation exists in the art to form HSG silicon by ALD. The redistribution anneal of amorphous silicon described in paragraph [0010] of Ra to form HSG silicon would clearly redistribute the highly ordered atoms deposited by ALD and it appears would negate any advantage of forming such amorphous silicon by ALD. Accordingly, those of ordinary skill would not use ALD for depositing amorphous silicon to become HSG silicon. At least for the reasons described herein, Applicant asserts that Ra does not disclose atomic layer depositing the claimed barrier layer.

A finding of anticipation requires disclosure of each and every element of claim 1. However, Ra is deficient in such respect and does not anticipate claim 1. Claims 2-8 and 11 depend from claim 1 and are not anticipated at least for such reason as well as for the additional limitations of such claims not disclosed. For example, claim 5 sets forth a list of compositions for the atomic layer deposited barrier layer. Page 4 of the Office Action alleges that pages 13-14 of Ra disclose the claimed compositions. However, pages 13-14 of Ra and elsewhere throughout Ra merely describe that a top electrode may include conductive thin film 308 and remaining portion 310 and provides TaN as an example for thin film 308. Ra does not disclose any of the other compositions listed in claim 5, such as WN, as alleged by the Office. Further, claim 5, by its dependence from claim 1, sets forth that the capacitor dielectric layer is formed over the conductive barrier layer to oxygen diffusion. In Ra the order is reversed with the TiN formed over dielectric layer 302. Accordingly, Ra does not disclose the subject matter of claim 5.

Applicant notes that claim 1 is amended herein to incorporate all the subject matter of claim 9 that depended therefrom. Claim 9 was before the Office in preparing the present Action but was erroneously rejected. Accordingly, the entire subject matter of

amended claim 1 presented herein was previously presented to the Office and the Office cannot now allege that any subsequent new ground of rejection of claim 1 was necessitated by Applicant's amendment herein. Any new ground of rejection of claim 1 must be presented in a non-final rejection. The Office may contact the undersigned with any disagreement regarding this matter that may arise prior to mailing the next action.

Amended claim 13 sets forth a capacitor fabrication method that includes, among other features, forming a first capacitor electrode, chemisorbing a first precursor and a second precursor over the first electrode to provide a chemisorption product comprised by a layer of a conductive barrier material, forming a capacitor dielectric layer over the barrier layer, and forming a second capacitor electrode over the dielectric layer. Pages 3-4 of the Office Action allege that Ra discloses the subject matter of claim 13. However, as may be appreciated from the above discussion regarding the deficiencies of Ra as applied to claim 1, Ra fails to disclose a layer of a conductive barrier material over the first capacitor electrode and a capacitor dielectric layer over the barrier layer. Claims 14 and 16-25 depend from claim 13 and are not anticipated at least for such reason as well as for the additional limitations of such claims not disclosed.

Amended claim 34 sets forth a capacitor fabrication method that includes, among other features, forming a first capacitor electrode containing silicon, atomic layer depositing a metal-containing conductive layer over the first electrode, forming a capacitor dielectric layer over the atomic layer deposited conductive layer, and forming a second capacitor electrode over the dielectric layer. Page 3 of the Office Action alleges that HSG layer 304 discloses the claimed metal-containing conductive layer. However, as may be appreciated from the above discussion regarding the deficiencies of Ra as applied to claim 1, HSG layer 304 is not a metal-containing conductive layer. Also, Ra does not disclose atomic

layer depositing HSG layer 304. Further, Ra does not disclose a capacitor dielectric layer over an atomic layer deposited conductive layer. At least for such reasons, Ra does not disclose the subject matter of claim 34. Claims 35-39 depend from claim 34 and are not anticipated at least for such reason as well as for the additional limitations of such claims not disclosed. For example, claims 36 and 37 set forth compositions for the atomic layer deposited conductive layer. As may be appreciated from the discussion above regarding the deficiencies of Ra as applied to claim 5, Ra does not disclose the subject matter of claims 36 or 37.

Amended claim 40 sets forth a capacitor fabrication method that includes, among other features, forming a first capacitor electrode containing silicon, chemisorbing a first and second precursor to form a chemisorption product comprised by a layer of a metal-containing conductive material, forming a capacitor dielectric layer over the conductive layer, and forming a second capacitor electrode over the dielectric layer. The Office Action does not present any specific ground of rejection regarding claim 40, accordingly, Applicant can only presume that the Office alleges grounds of rejection similar to those specifically presented for claims 1, 13, and 34. As may be appreciated from the discussion herein regarding the deficiencies of Ra as applied to claims 1 and 13, Ra does not disclose a chemisorption product of first and second precursor layer being comprised by a layer of a metal-containing conductive material with a capacitor dielectric layer over the conductive layer. Applicant asserts that claim 40 is thus not anticipated by Ra. Claims 41 and 43-47 depend from claim 40 and are not anticipated at least for such reason as well as for the additional limitations of such claims not disclosed.

At least for the reasons established herein, claims 1-8, 11, 13, 14, 16-25, 34-41, and 43-47 are not anticipated by Ra and Applicant requests allowance of such claims in the next Office Action.

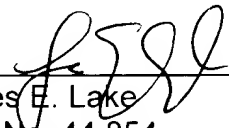
Claims 10, 12, 15, 42, and 48-75 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Ra. Applicant requests reconsideration.

Claims 10, 12, 15, 42, and 48-75 depend from claims 1, 13, 34, or 40. Applicant establishes herein that the subject matter of independent claims 1, 13, 34, or 40 are not disclosed by Ra. Applicant further asserts that Ra does not suggest the subject matter of the independent claims that is otherwise not disclosed by Ra. The mere fact that the prior art can be modified does not make the modification obvious "unless the prior art suggested the desirability of the modification." In re Gordon, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984), MPEP 2143.01. Applicant asserts that Ra does not suggest the desirability of any modifications to the disclosure of Ra such that the claimed subject matter results. Also, Applicant asserts that the Office Action does not allege that Ra provides any such motivation. Accordingly, claim 10, 12, 15, 42, and 48-75 are patentable over Ra and Applicant requests allowance of such claims in the next Office Action. Any subsequent allegation by the Office that Ra somehow suggests modifications to yield the claimed subject matter, thus constitutes a new ground of rejection.

In keeping with the assertions herein, Applicant asserts that claims 1-8, 10-25, and 34-75 are in condition for allowance and Applicant requests such allowance in the next Office Action.

Respectfully submitted,

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